Project Planning and Estimation with Ask Pete

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Overview

- Overview
  - Who, What, When, How, Why
- How's It Work?
  - Methodologies
  - COCOMO II
  - Control Levels
  - IV&V Criteria
- Capabilities
- Reports
- Future Plans
- Summary

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Overview
Who, What, When, How, Why?

Started life as the Software Project Expert System (SPES)

Pete is a computer application for:

- **P**rojects with software development
- **E**stimating duration, cost, schedule
- **T**ool for planning project, SPA and IV&V activities
- determining the **E**ffort (tasks) based on the COCOMO, SW reuse (COTS/GOTS), Control Levels, IV&V criteria and documentation

What

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Overview
Who, **What**, When, How, Why?

Ask Pete incorporates:

- COCOMO II
- SLOC or Function Points
- GRC's Software Development Procedure & Control Levels
- NASA's IV&V Criteria
- Plan Templates
- CMM Checklist
- Advanced Risk Reduction Tool (ARRT) Tailoring

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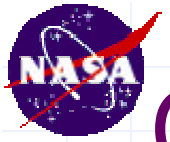

Overview

Who, What, **When**, How, Why?

1998	1999	2000	2001
Java interface	VB interface	Print, Save formatted report capability	CMM calculator
COCOMO & Control Levels	Versioning	SPA, Comparison, Responses, SDP reports	Function Points
Results report	Help system	Project properties	SDP template editor
	Distribution web site and statistics	Question comments	Link to ARRT risks
	User's Guide, Programmer's Manual	Integrated with ARRT	Added SQA metrics collection

How
VB

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Overview
Who, What, When, **How**, Why?

The VB User Interface contains:

- Logic that
  - Manages the interface to the database
  - Generates tailored reports
  - Real-time cues that show the effects of tradeoffs
- Help system
- Links to the support web site and for email assistance

How Access

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Overview

Who, What, When, **How** (cont.), Why?

An MS Access database contains:

- All the questions
- And answers
- Project information
- The decision structure to determine
  - Cost and schedule estimates
  - Control Levels
  - Need for Independent Assessment (IA) or IV&V,
- Other report information

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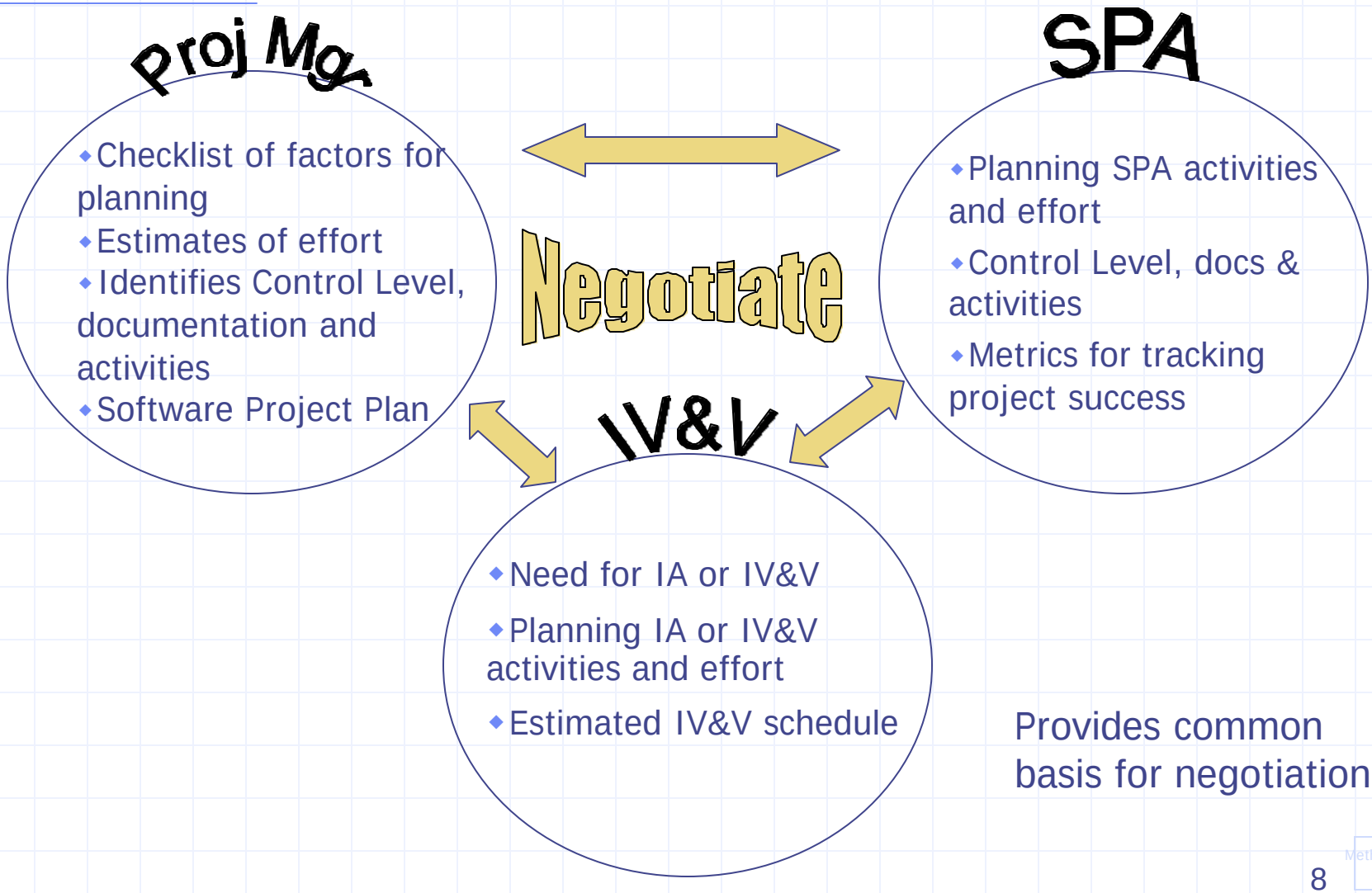
Capabilities

Who, What, When, How, **Why**?



Provides common basis for negotiations

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How's It Work
Methodologies

COCOMO II

Product
- ✓Required reliability
- ✓Test data size
- ✓Complexity
- ✓Reusability requirement
- ✓Documentation requirements

Platform
- ✓Execution time
- ✓Storage
- ✓Platform volatility

Personnel
- ✓Analyst, programmer capability
- ✓Platform, applications experience
- ✓Language/tool experience
- ✓Personnel continuity

Project
- ✓Tool Usage
- ✓Multisite development
- ✓Required schedule

Control Level

Resourcing
- ✓Annualized cost

Organizational Complexity
- ✓Development locations
- ✓Customers
- ✓Developers experience

Technical Complexity
- ✓Test risk
- ✓Innovation
- ✓Development tool availability
- ✓Interdependency of deliverables

Safety Implications
- ✓Potential damage
- ✓Potential injury

Business Implications
- ✓Consequence of failure
- ✓Schedule pressure

IV&V Criteria

Consequences
- ✓Personnel
- ✓Money and personnel
- ✓Mission success
- ✓Adverse publicity
- ✓Equipment
- ✓Effect on operations

Likelihood
- ✓Team size
- ✓Use of contractors
- ✓Development location(s)
- ✓Schedule
- ✓CMM level
- ✓Innovation
- ✓Integration
- ✓Requirements stability
- ✓Amount of code

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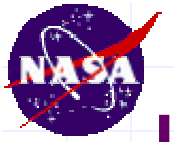

How's It Work
COCOMO II

Information derived from COCOMO II

- Size of project (SLOC)
  - Effects of Software Reuse
  - Effects of requirements creep
  - Function Points
- Schedule estimate
- Personnel requirements
- Estimated cost of development

Ref. Boehm, 1981. B. Boehm, *Software Engineering Economics*, Prentice Hall, Englewood Cliffs, NJ, 1981
Boehm, 2000. B. Boehm, *Software Cost Estimation with COCOMO II*, Prentice Hall, Englewood Cliffs, NJ, 2000
http://sunset.usc.edu/research/COCOMOII/index.html

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How's It Work

Control Levels

Information derived from Control Levels:

- Development lifecycle
- Development activities
- Documentation requirements

Ref. GRC P2.6.4 Implementation – Software Development, Rev. C,
http://nasalivelink.grc.nasa.gov/livelink/livelink?func=ll&objId=241550&objAction=browsebmsfolder&sort=documentnumber
LeR-M2.6.4 Glenn Research Center Software Development Manual, Rev B
http://nasalivelink.grc.nasa.gov/livelink/livelink?func=ll&objId=834250&objAction=browse&sort=documentnumber

Control level lifecycle

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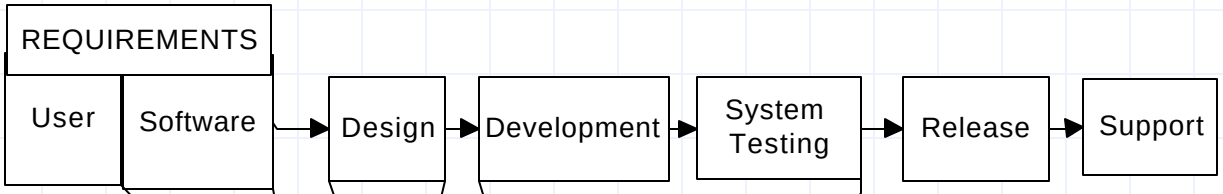
How's It Work

Control Levels

Software Control Levels

- Critical/High Control Level
- Medium Control Level
- Low Control Level

CRITICAL/HIGH CONTROL PROCESS:



MEDIUM CONTROL PROCESS:

LOW CONTROL PROCESS:

Control Level Activities

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How's It Work

Control Levels

Control Level determine extent of the development activities that are performed in the following areas:

- Verification and validation
- CM and SQA
- Software safety
- Software risk management
- Software requirements
- Software inspections

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How's It Work

Control Levels

Pact Title	Low	Medium	High	Critical
Requirements	X	X	X	X
Authorization to proceed	X	X	X	X
Identify design/coding standards	X	X	X	X
Maintain Software Development Folder		X	X	X
Software Assurance reviews Management Plan		X	X	X
Implement Problem report and corrective action system		X	X	X
Management Plan approval	X	X	X	X
Documented requirements	X	X	X	X
Peer review of requirements		X	X	X
Conduct formal inspection of requirements				X
Software Assurance reviews requirements			X	X
Requirements approval	X	X	X	X
Peer review of plans			X	X
Implement Formal configuration management			X	X
Conduct Product Assurance Audits			X	X
Conduct Formal Review s			X	X
Document approval of requirements and formal review			X	X
Customer approval of certification procedures				X
Conduct analyses of criticality and safety				X
Plan and schedule IV&V activities				X
Identify method for verification of safety critical functions and requirements				X

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How's It Work

IV&V Criteria

Information derived from IV&V Criteria:

- Need for IV&V or Independent Assessment based on:
  - Consequences of failure
    - Grave
    - Substantial
    - Marginal
    - insignificant
  - Likelihood of failure
    - Range from 16 to 256
- IV&V and Independent Assessment Activities
  - If IA or IV&V indicated, a base set of activities are included in the recommended development activities

Ref. NPG 8730 Software Independent Verification and Validation (IV&V) Management, Rev. Draft

IV&V chart

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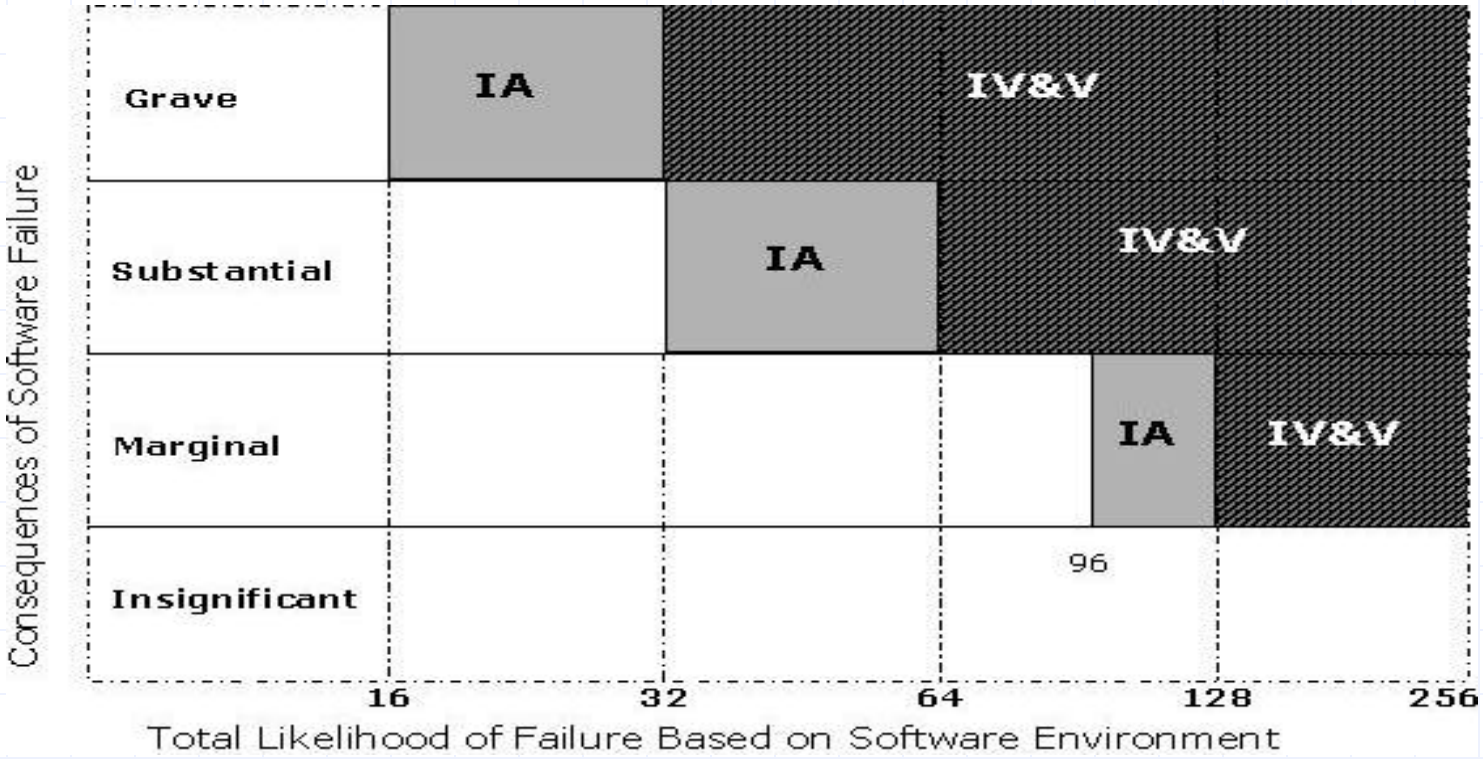
How's It Work

IV&V Criteria – IA / IV&V Determination



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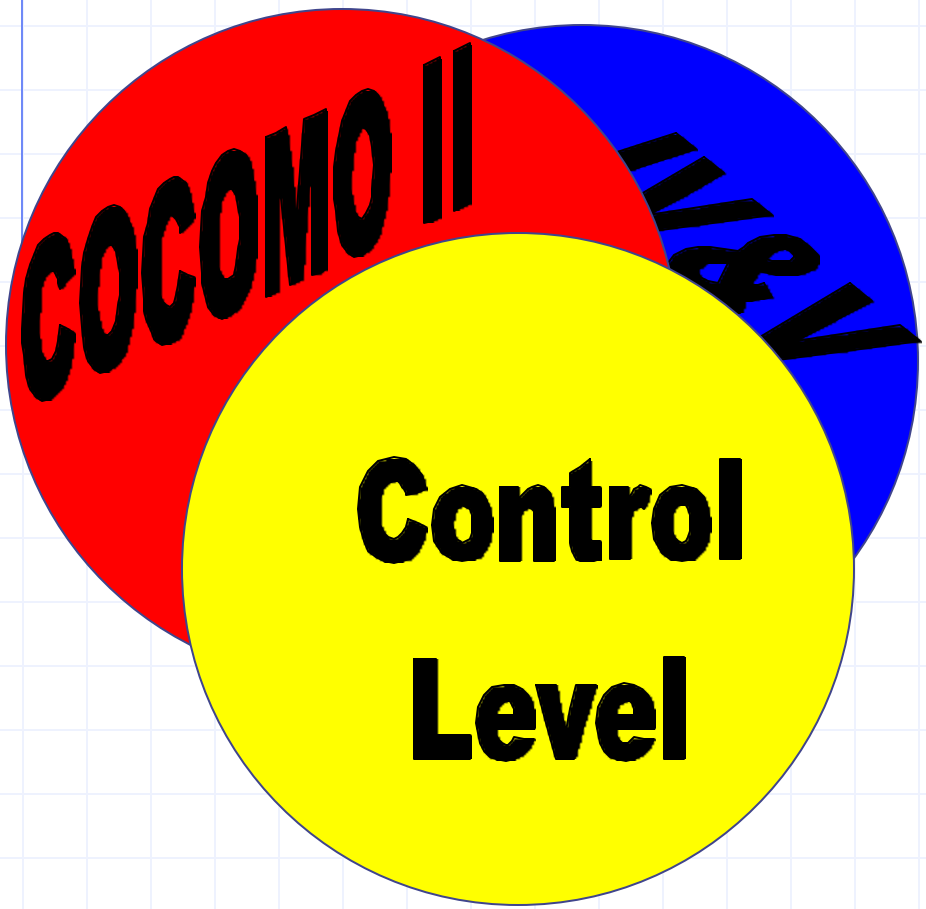
How's It Work



- COCOMO II factors address majority of the development planning issues
- Control Level factors overlap COCOMO II and address additional organizational and performance issues
- Incorporating other areas of interest, (i.e. IV&V, Software Assurance), build on COCOMO II and Control level questions

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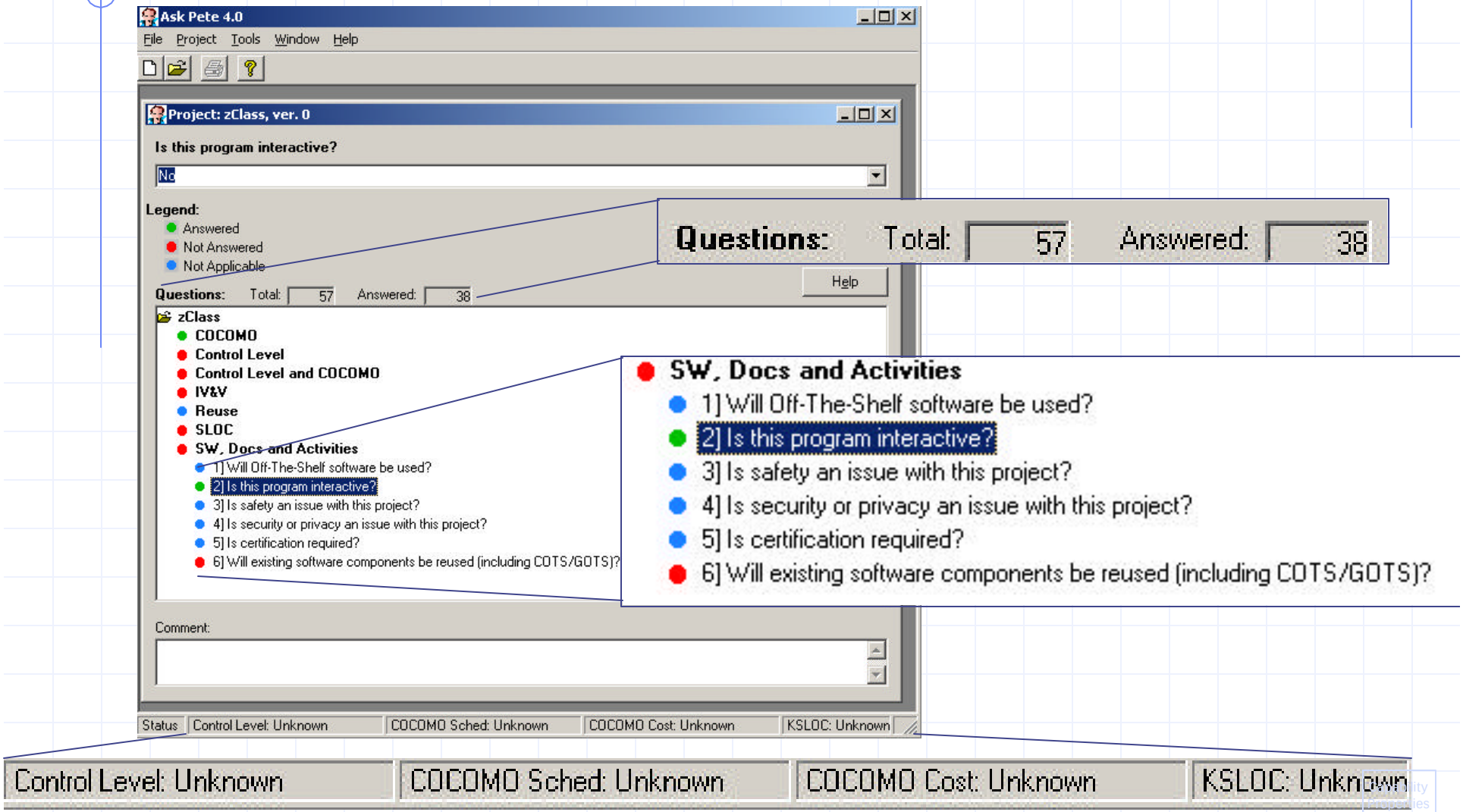
Capabilities

Characterize Projects



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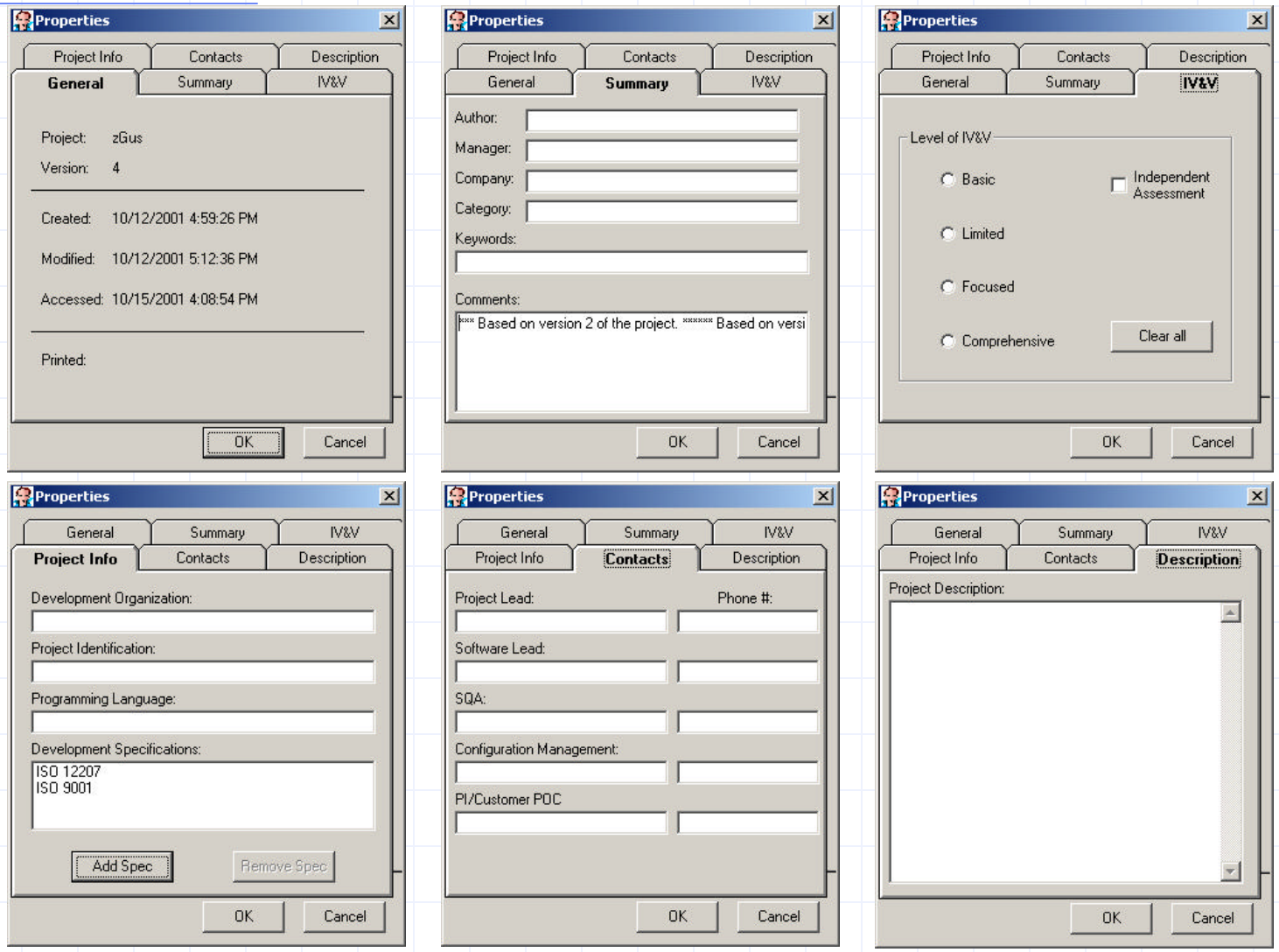
Capabilities

Project Properties



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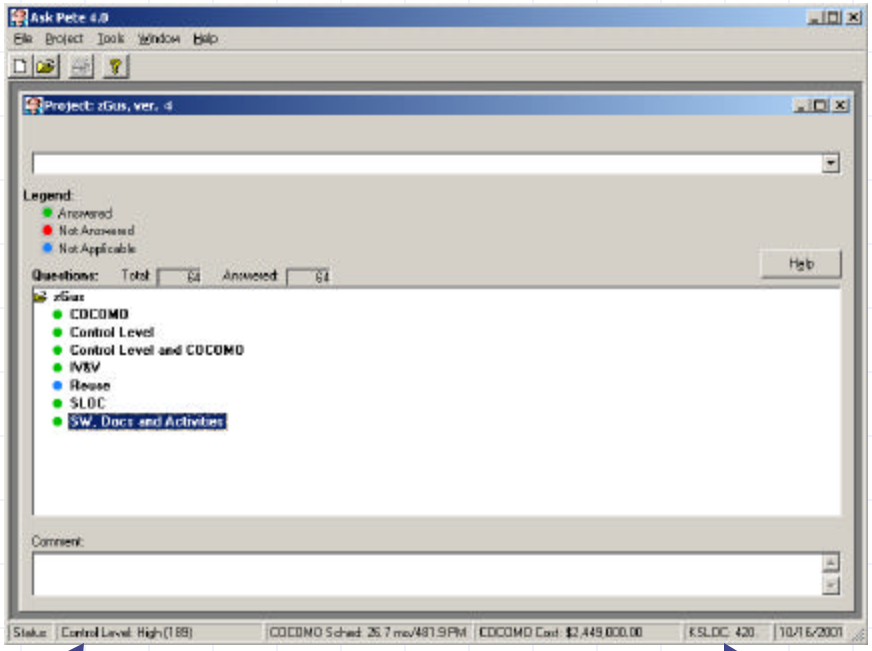
Capabilities

Characterized Project



Control Level: High (189)

KSLOC: 420.

COCOMO Sched: 26.7 mo/481.9 PM

COCOMO Cost: $2,449,000.00

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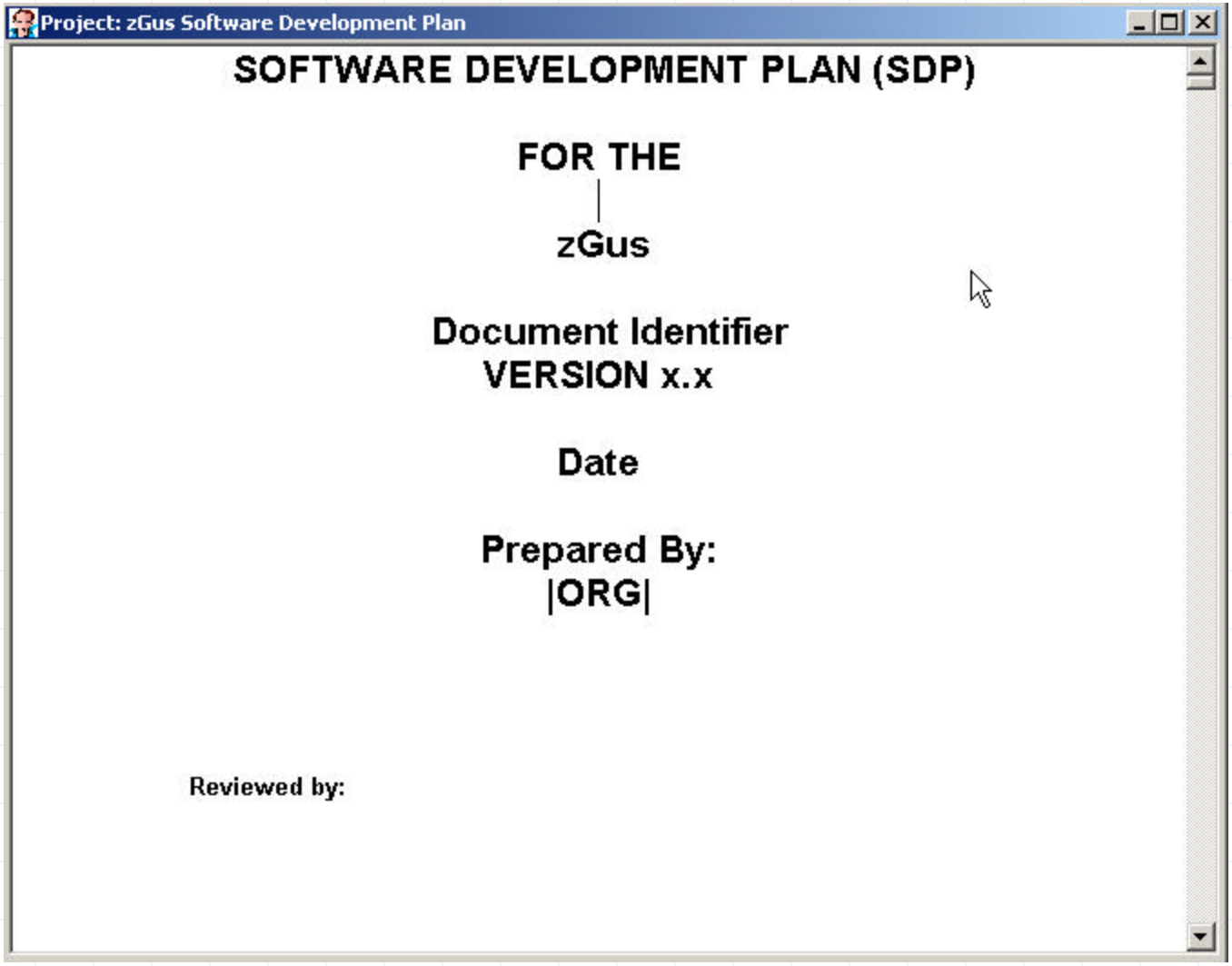
Reports

Software Development Plan



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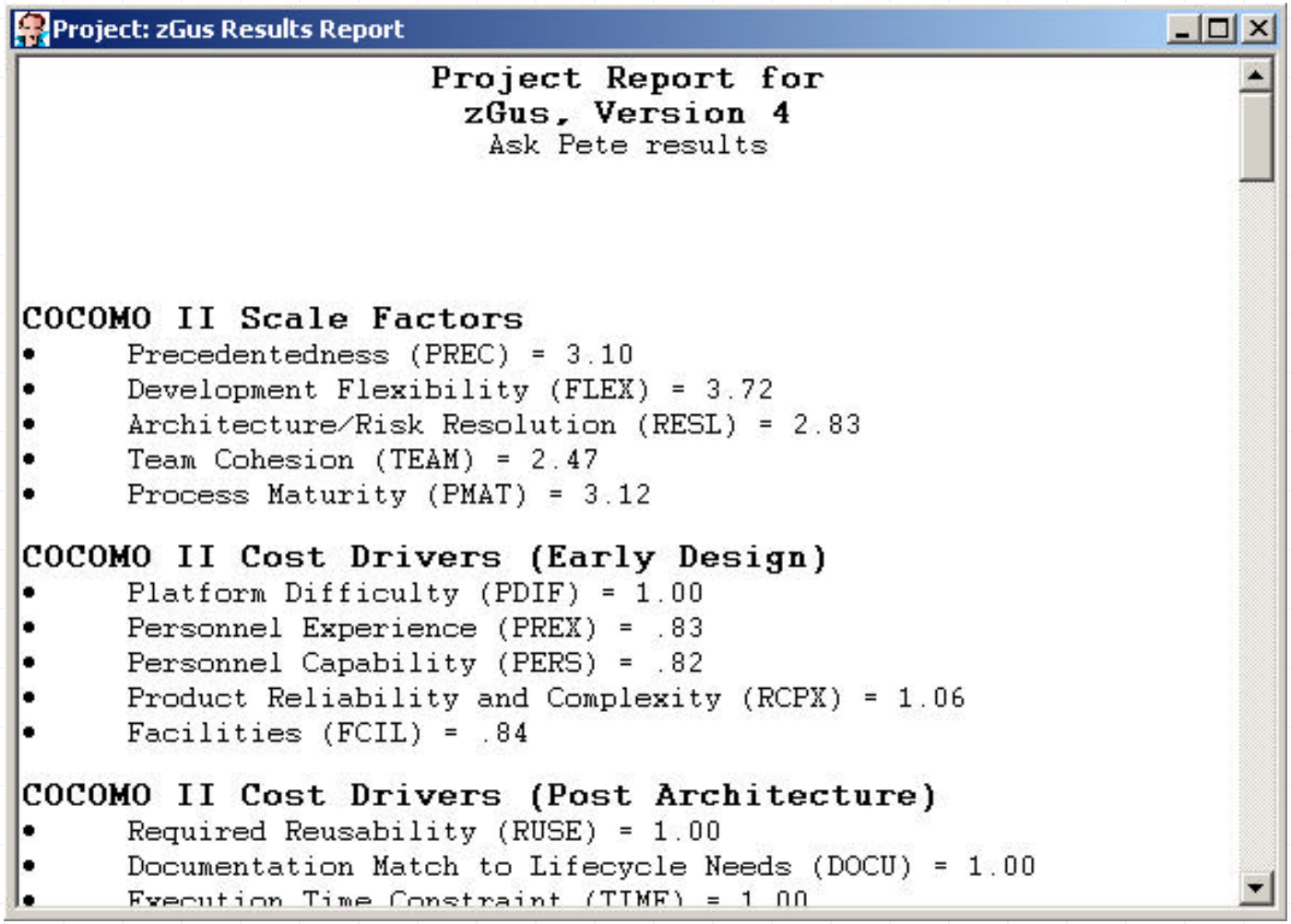
Reports

Results Report – COCOMO II Factors



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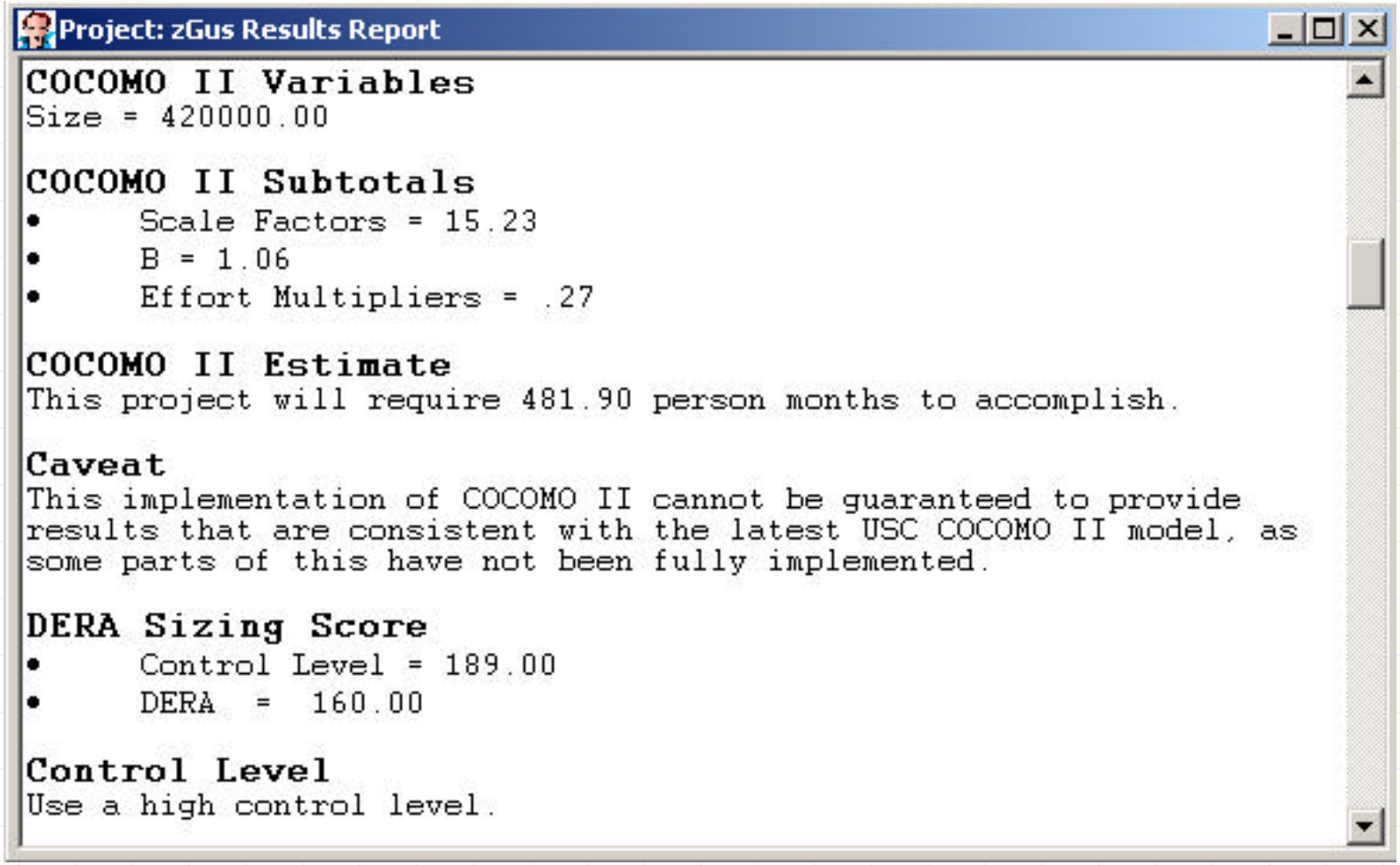
Reports

Results Report – SLOC Estimate, Control Level



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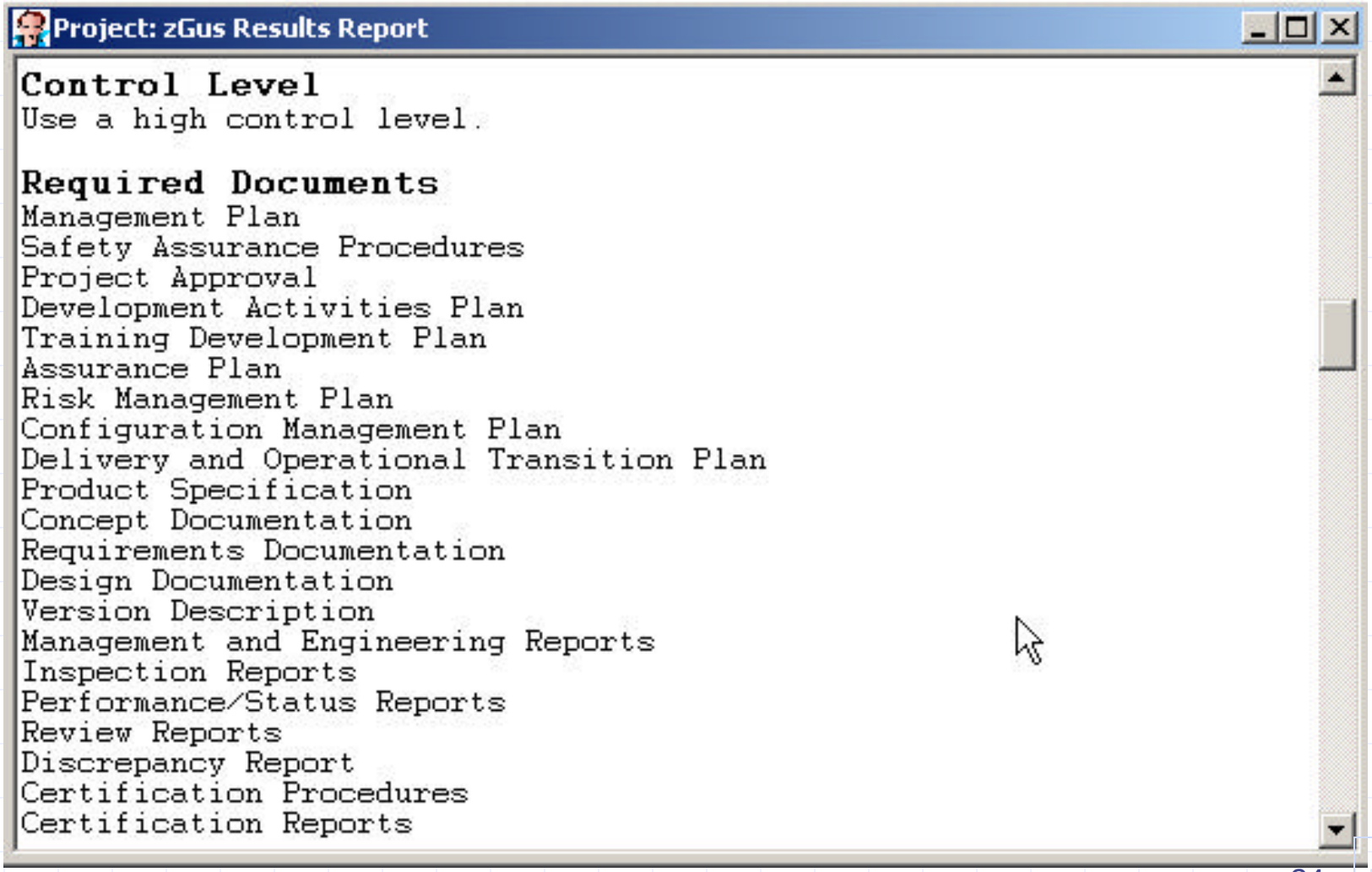
Reports

Results Report – Recommended Documents



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Reports

Results Report – Phase Activities

Report Results

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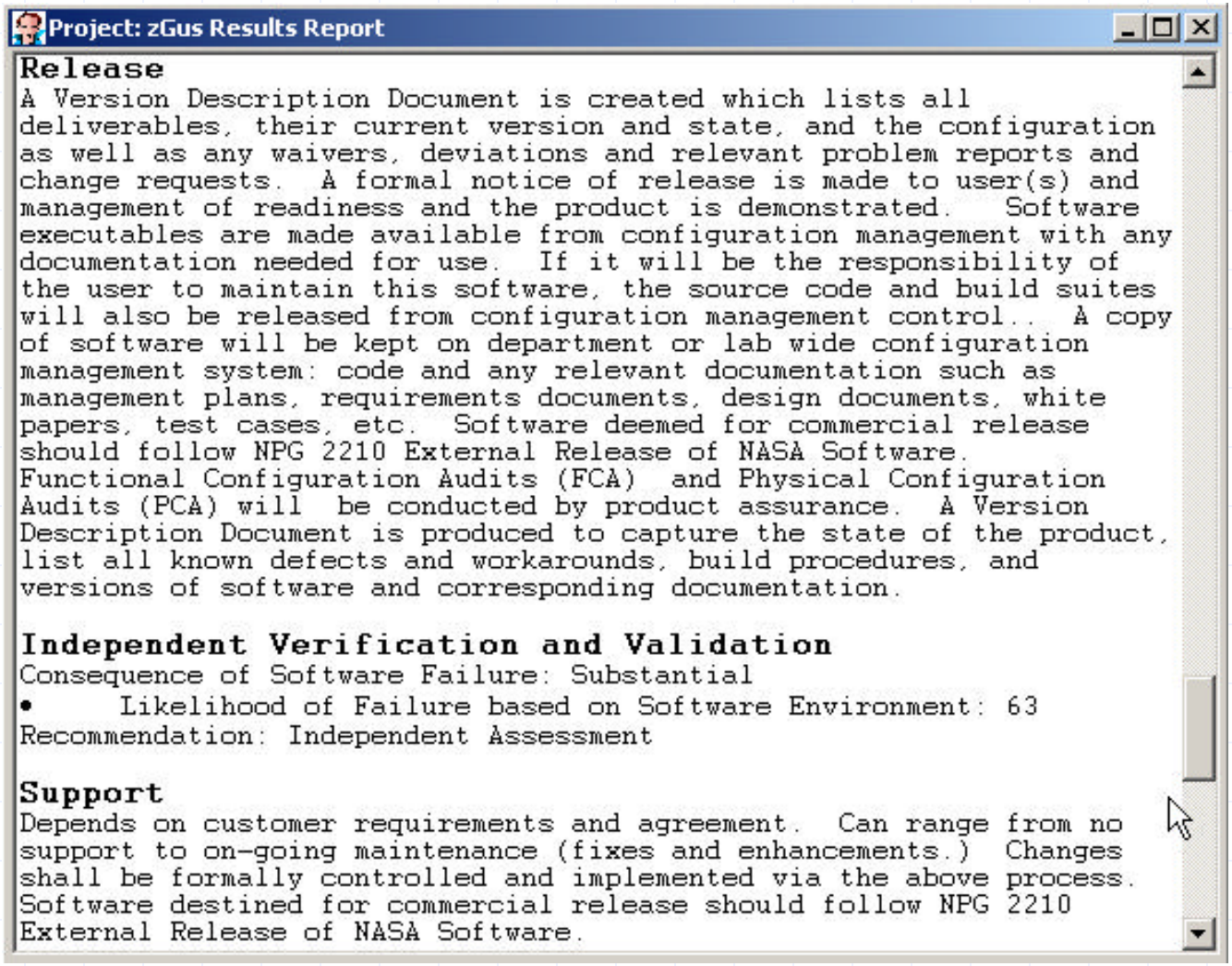
Reports

Results Report – IV&V Recommendation



Report Results

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Reports

Results Report – COCOMO II Phase Estimate

Project: zGus Results Report

Phase Estimates

NOTE: The COCOMO calculation does not include estimates for the Plans and Requirements phase. An assumption has been made for the following results that the Plans and Requirements phase is equal to 7% of the effort and schedule of the Product Design, Programming, and Integration and Test phases. Because this assumption is not part of the calculated COCOMO II result, it is not included in the totals at the end of this section or in the figures shown on the status bar. The information provided here is based on a typical project and has not been optimized for zGus~004. It should be used as a guide only for developing initial staffing and schedule estimates.

Estimate for total development effort = 26.7 months.
The schedule breaks down as follows:

Plans and Requirements
- 33.7 PM
- 5.7 mo.
- 5.9 FTE

Product Design
- 81.9 PM
- 7.4 mo.
- 11.1 FTE

Programming
- 254.1 PM
  - Detailed Design: 112. PM
  - Code & Unit Test: 142.1 PM
- 10.9 mo.
- 23.2 FTE

Integration and Test
- 145.9 PM
- 8.4 mo.
- 17.5 FTE

Project Totals
- Total Effort: 481.9 PM
- Total Schedule: 26.7 mo.
- Average Staffing: 18. FTE

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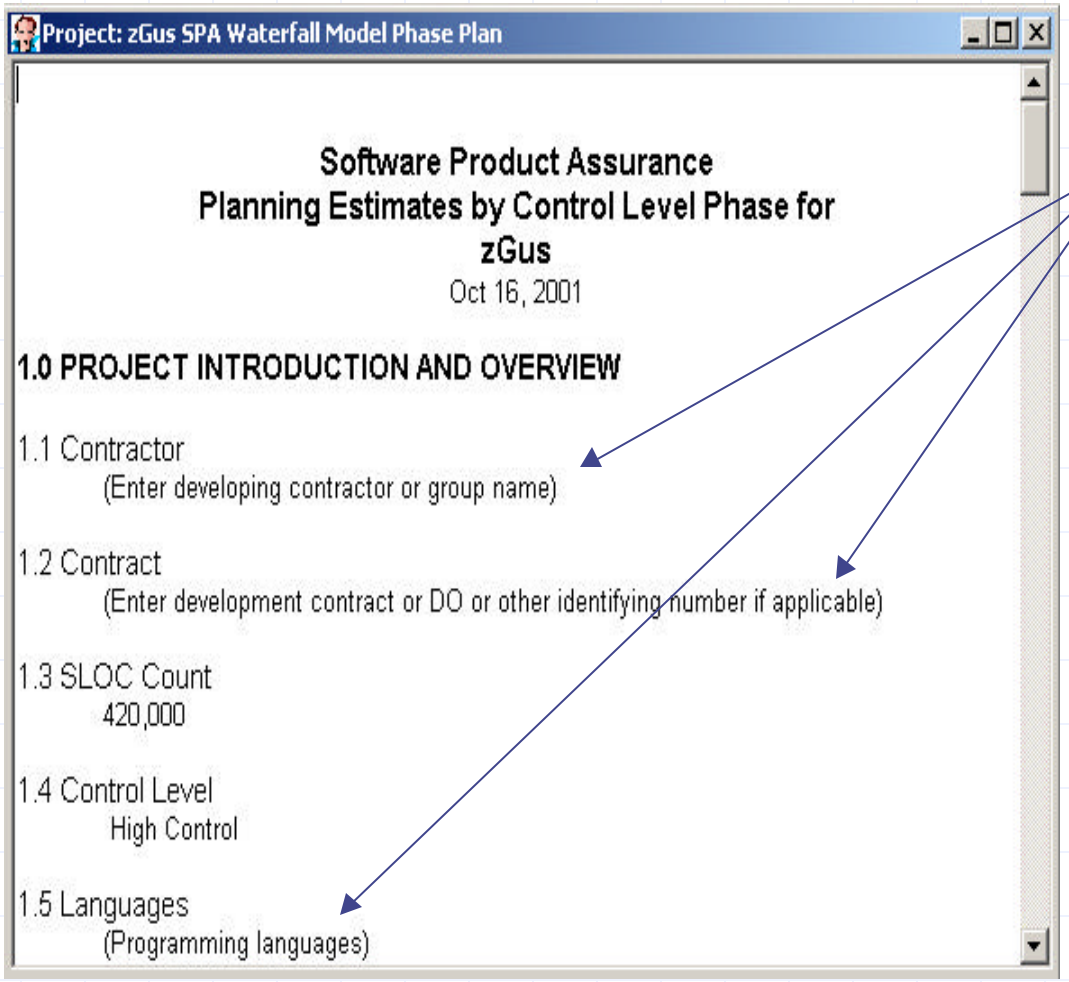
Reports

SPA Report



Text in parentheses replaced by project properties information if available

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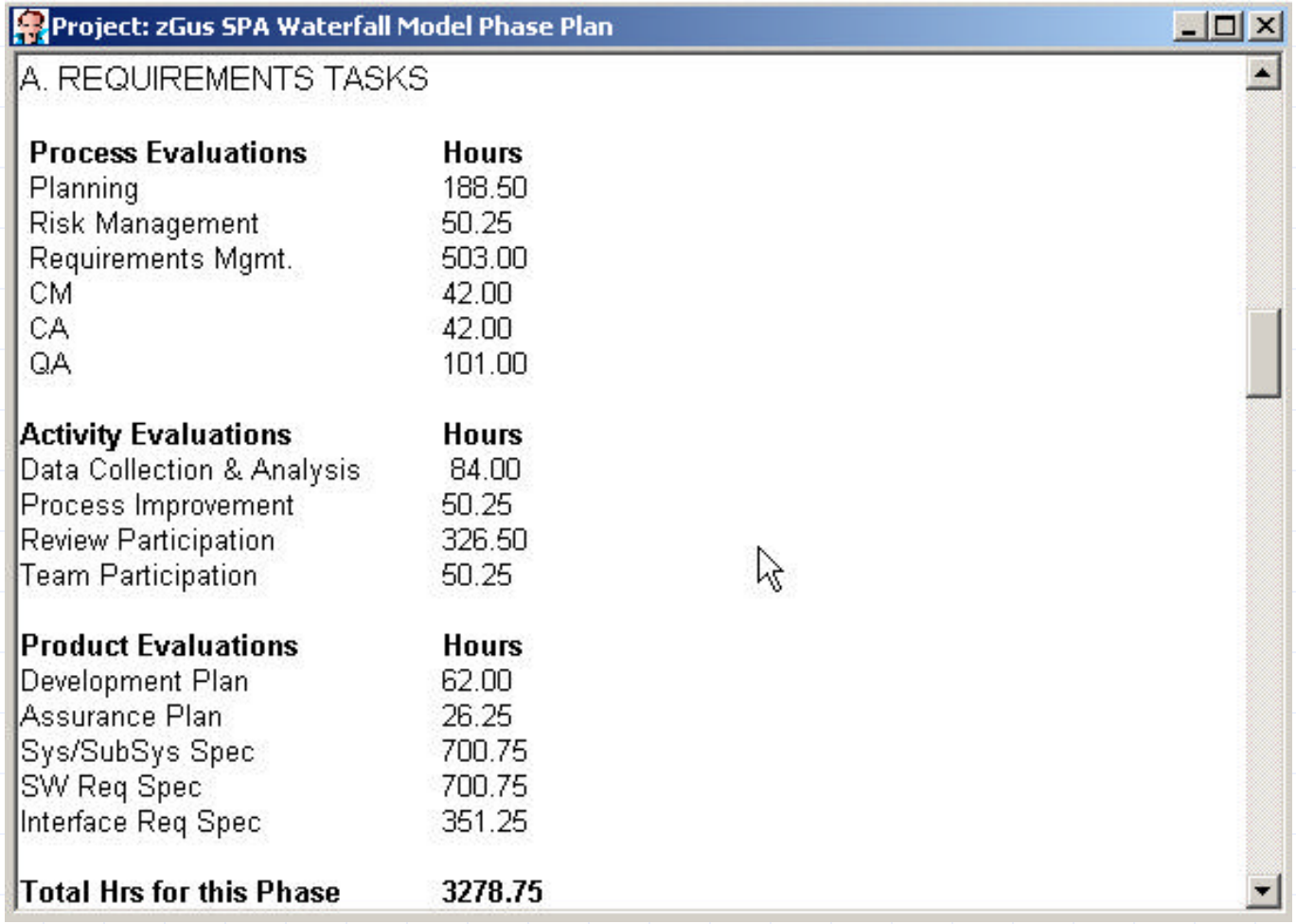
Reports

SPA Report



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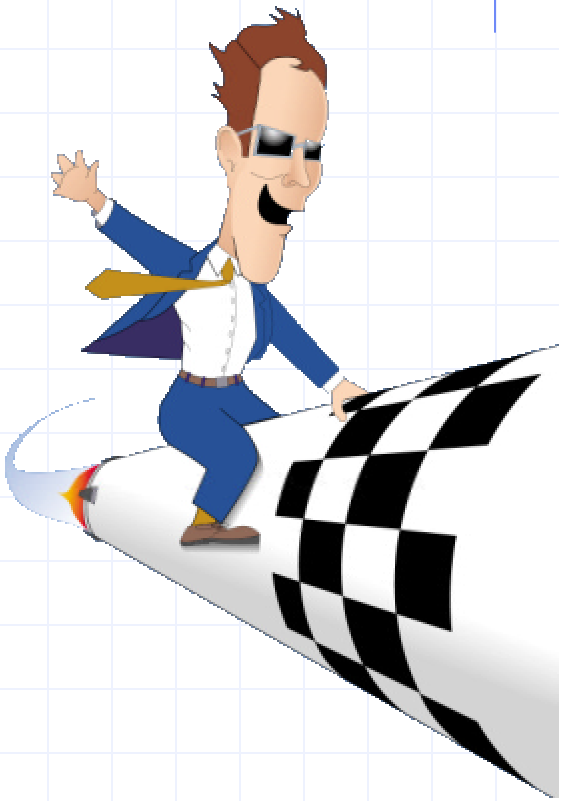
Future Plans

- Develop and provide training and informational presentations at NASA centers, conferences
- Develop and finalize plan templates (SQA, SDP)
- Implement ability to decompose/combine projects
- Investigate conversion to web-based application



Summary

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Summary

- Answered Who, What, Where, When, How and Why?
- Training sessions and presentations at NASA Centers next year
- Incorporates COCOMO II, (tailorable) Control Levels and IV&V criteria
- Overview of the program and reports
- Download your copy from http://tkurtz.grc.nasa.gov/pete

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